1. Subbasin Assessment – Watershed Characterization

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters (33 USC § 1251.101). States and tribes, pursuant to section 303 of the CWA are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the waters whenever possible. Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list of impaired waters, currently every two years. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. This document addresses the water bodies in the Goose Creek Subbasin on the 1998 "§303(d) list."

The overall purpose of this SBA (SBA) and TMDL is to characterize and document pollutant loads within the Goose Creek Subbasin. The first portion of this document, the SBA, is partitioned into four major sections: watershed characterization, water quality concerns and status, pollutant source inventory, and a summary of past and present pollution control efforts (Chapters 1 – 4). From the subbasin information, a TMDL will be developed for each pollutant of concern for the listed Goose Creek systems (Chapter 5).

1.1 Introduction

In 1972, Congress passed the Federal Water Pollution Control Act, more commonly called the Clean Water Act. The goal of this act was to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (Water Pollution Control Federation 1987). The act and the programs it has generated have changed over the years as experience and perceptions of water quality have changed. The CWA has been amended 15 times, most significantly in 1977, 1981, and 1987. One of the goals of the 1977 amendment was protecting and managing waters to insure "swimmable and fishable" conditions. This goal, along with a 1972 goal to restore and maintain chemical, physical, and biological integrity, relates water quality with more than just chemistry.

Background

The federal government, through the U.S. Environmental Protection Agency (EPA), assumed the dominant role in defining and directing water pollution control programs across the county. The Department of Environmental Quality (DEQ) implements the CWA in Idaho, while the EPA oversees Idaho and certifies the fulfillment of CWA requirements and responsibilities.

Section 303 of the CWA requires DEQ to adopt, with EPA approval, water quality standards and to review those standards every three years. Additionally, DEQ must monitor waters to identify those not meeting water quality standards. For those waters not meeting standards, DEQ must establish TMDLs for each pollutant impairing the waters. Further, the agency must set appropriate controls to restore water quality and allow the water bodies to meet their designated uses. These requirements result in a list of impaired waters called the "§303(d) list." This list describes water bodies not meeting water quality standards. Waters identified on this list require further analysis. A SBA and TMDL provide a summary of the water quality status and allowable TMDL for water bodies on the §303(d) list. *Goose Creek Subbasin Assesssment and Total Maximum Daily Loads* provides this summary for the currently listed waters in the Goose Creek Subbasin.

The SBA section of this report (Chapters 1 – 4) includes an evaluation and summary of the current water quality status, pollutant sources, and control actions in the Goose Creek Subbasin to date. While this assessment is not a requirement of the TMDL, DEQ performs the assessment to ensure impairment listings are up to date and accurate. The TMDL is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (40 CFR Part 130). Consequently, a TMDL is water body- and pollutant-specific. The TMDL also includes individual pollutant allocations among various sources discharging the pollutant. The EPA considers certain unnatural conditions, such as flow alteration, a lack of flow, or habitat alteration, that are not the result of the discharge of specific pollutants as "pollution." TMDLs are not required for water bodies impaired by pollution, but not specific pollutants. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.

Idaho's Role

Idaho adopts water quality standards to protect public health and welfare, enhance the quality of water, and protect biological integrity. A water quality standard defines the goals of a water body by designating the use or uses for the water, setting criteria necessary to protect those uses, and preventing degradation of water quality through antidegradation provisions.

The state may assign or designate beneficial uses for particular Idaho water bodies to support. These beneficial uses from the Idaho water quality standards include:

- Aquatic life support – cold water, seasonal cold water, warm water, salmonid spawning, modified
- Contact recreation – primary (swimming), secondary (boating)
- Water supply – domestic, agricultural, industrial
- Wildlife habitats, aesthetics

The Idaho legislature designates uses for water bodies. Industrial water supply, wildlife habitat, and aesthetics are designated beneficial uses for all water bodies in the state. If a water body is unclassified, then cold water and primary contact recreation are the default designated uses.

A SBA entails analyzing and integrating multiple types of water body data, such as biological, physical/chemical, and landscape data to address several objectives:

- Determine the degree of designated beneficial use support of the water body (i.e., attaining or not attaining water quality standards).

- Determine the degree of achievement of biological integrity.

- Compile descriptive information about the water body, particularly the identity and location of pollutant sources.

- When water bodies are not attaining water quality standards, determine the causes and extent of the impairment.

1.2 Physical and Biological Characteristics

The characterization of the Goose Creek Subbasin will be based on its physical and biological features and how they interplay with ecoregional and hydrological traits. The Goose Creek Subbasin is complex in its characterization, principally due to a plurality of land types within the Idaho portion of the subbasin. There are highly accessible river corridors where agricultural pastureland activities dominate the land use. Adjacent to these lands are the low mountainous areas from which the majority of water in the subbasin comes and rangeland land use activities dominate. In contrast to these areas is the wide, relatively flat, valley floor of the Snake River Basin from the city of Oakley to the lower reaches of the subbasin where row crop agriculture dominates the land use. Additionally, there are many sources of water in the subbasin. Much of the water for the two large streams (Goose Creek and Trapper Creek) comes from snowpack and rainfall in the mountain ranges in the western portion of the subbasin. However, many of these small feeder streams arise from springs and precipitation events on the eastern mountains. An additional factor in the subbasin complexity is the issue of nonpoint source pollution within the watersheds. Many factors influence the type and rate of nonpoint source pollution, such as soil characteristics, climate, vegetation, topography, and human activities.

Climate

The Goose Creek Subbasin begins in the mountains of the Northern Basin and Range ecological province and reaches northward to the lowlands of the Snake River Basin/High Desert. The pronounced differences in climate from the mountains to the Snake River Plain are due to the elevation difference across the subbasin. Precipitation varies from 28 to 48 centimeters (cm)/year on the lower elevations to 53 to 97 cm/year on the mountain summits (Figure 3) (See Appendix A for unit conversion factors). Using the Koeppen system of climate classification, the plains are “cold steppes” and the mountains are “undifferentiated highland climates” (Hansen 1975).

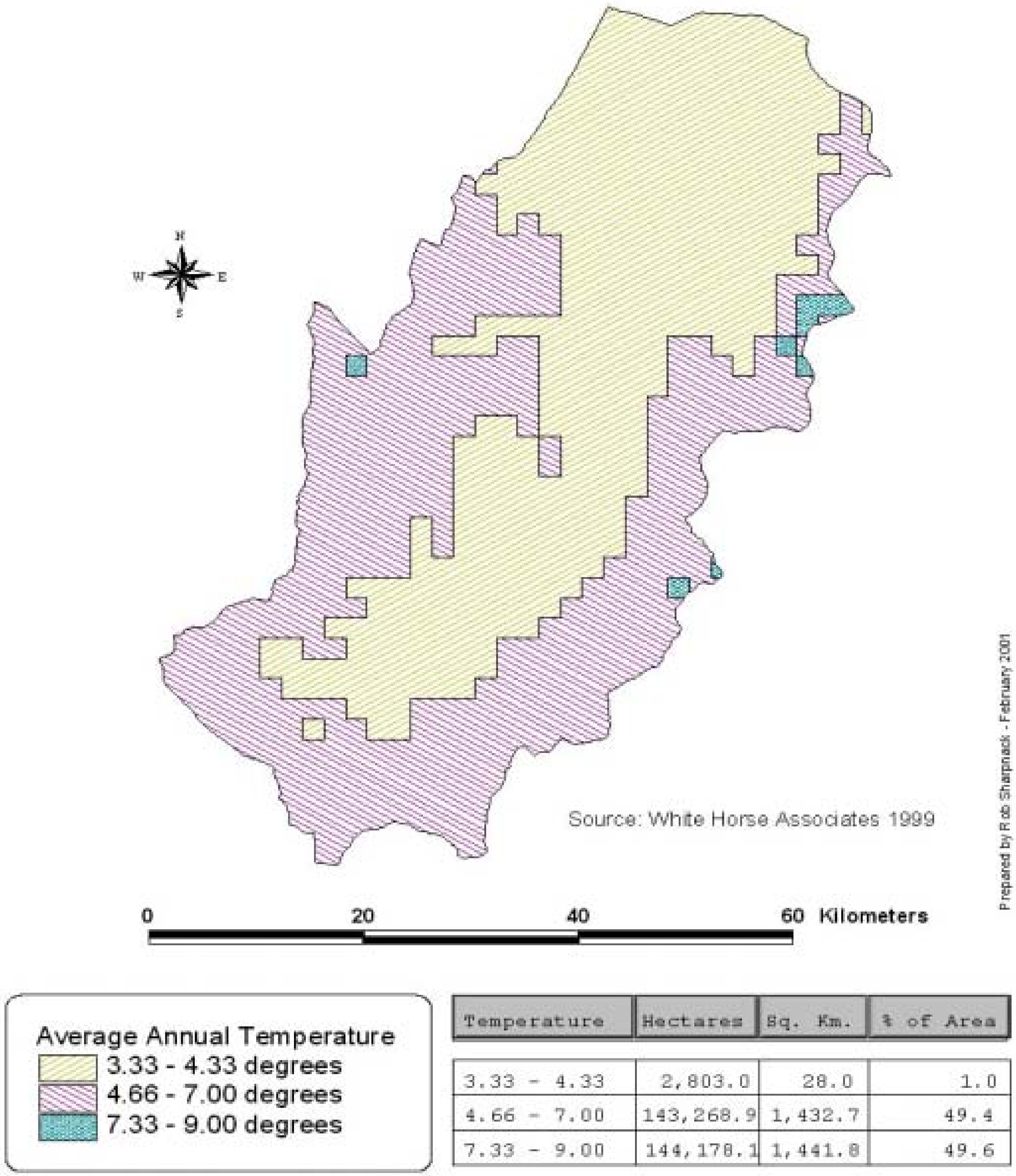
Only one climate station (Oakley) from the Western Regional Climate Center (www.wrcc.dri.edu 2000) is available within the subbasin to characterize the watershed. However, five others are near the subbasin. These are the Burley, Idaho airport; Grouse Creek, Utah; Jackpot, Nevada; Hollister, Idaho; and Strevell, Idaho. Because the majority of the climate stations are outside of the subbasin, there are few data sets available to characterize the bulk of the subbasin. As noted, nearly all the perennial flow in this watershed comes from the mountains to the south of the Snake River Plain, which do not have climate stations.

The town of Oakley is in the southern portion of the subbasin. The town is near the Snake River Plain at approximately 1,400 meters (m) in elevation. The climate is arid with an annual precipitation of 28 cm. Over one-half of the precipitation falls in March to June. The average snow depth in the winter months is 0 cm, except in January, which averages 2.54 cm. This indicates that precipitation in the form of snow does not accumulate to provide for a spring snowmelt runoff in the lower portions of the subbasin. The wettest months of the year are April, May, and June (3.05, 3.94, and 3.18 cm, respectively), while the driest months are February (1.68 cm), July (1.83 cm), and August (1.91 cm). However, for most months, outside of the wettest three, average precipitation is near the values for July and August. Monthly average precipitation is approximately 2.32 cm a month.

The town of Burley is approximately 32 kilometers (km) North of Oakley in the Snake River Basin Ecoregion. Burley lies between 1,264 m and 1,273 m elevation. It is in an arid climate, with an annual mean precipitation of just under 25.4 cm. The annual average temperature is 8.88 $^{\circ}$C, with cool winters and warm summers (Figure 3.).

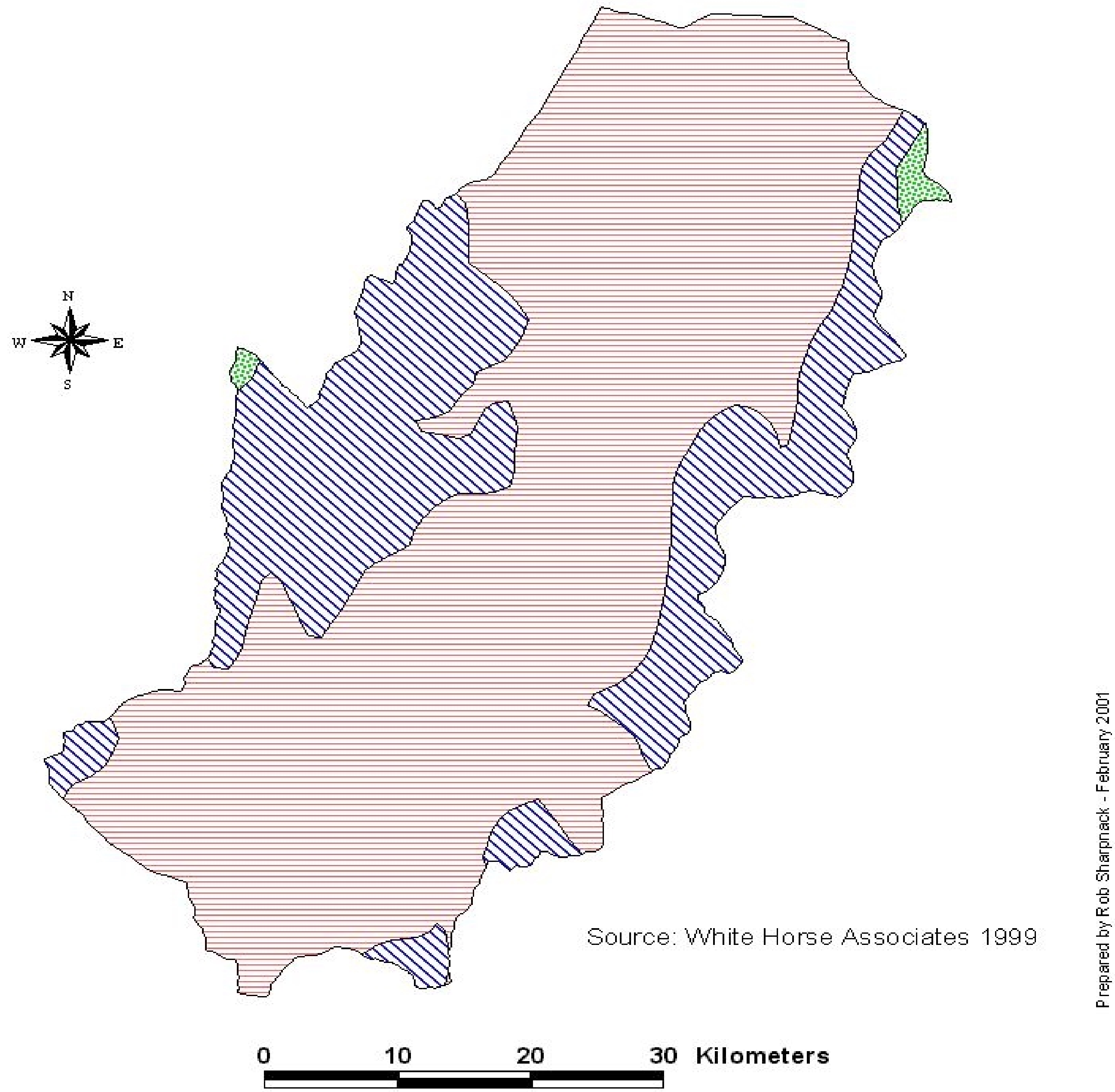
Subbasin Characteristics

Generally, the natural hydrology of an area is the result of its climactic regime, topography, and geology. Water in the Goose Creek Subbasin moves through a variety of pathways, dominated by the Goose Creek and Trapper Creek routes. Except for the two major mountainous southern drainages (Goose Creek and Trapper Creek), most of the surface channels are intermittent or ephemeral tributaries. Seasonally, ground water plays an unknown but significant role in the hydrology of several streams and rivers of the subbasin. Discussions of the hydrology of each stream will follow much later in this document.



Temperature	Hectares	Sq. Km.	% of Area
3.33 - 4.33	2,803.0	28.0	1.0
4.66 - 7.00	143,268.9	1,432.7	49.4
7.33 - 9.00	144,178.1	1,441.8	49.6

Figure 2. Average annual temperatures (in ° C) in the Goose Creek Subbasin.



Precipitation	Hectares	Sq. Km.	% of Area
27.94 - 43.18	208,348.0	2,083.5	71.8
43.18 - 66.04	79,950.0	799.5	27.5
66.04 - 96.52	1,951.1	19.5	0.7

Average Annual Precipitation (cm)
27.94 - 43.18
43.18 - 66.04
66.04 - 96.52

Figure 3. Average annual precipitation in the Goose Creek Subbasin.

The EPA Reach File, Version 3 (Basins 2.01 2000), was queried to generate a list of the perennial streams in the Idaho portion of the subbasin. Some of these streams may be intermittent or ephemeral, but the EPA reach file identifies them as perennial streams of the subbasin. Further investigations, ground-truthing, and cross-referencing with United States Geological Service (USGS) topographic maps will be required to determine if a stream is perennial. The reach file identified 60 streams as perennial in addition to the ones assessed in this document that are on the §303(d) list. Some of these streams will be assessed in upcoming years. Future iterations of the SBA-TMDL will include new streams not meeting their beneficial uses. Many of the remaining streams have had Beneficial Use Reconnaissance Program (BURP) data collected on them. Updated assessment guidance is available in *the Water Body Assessment Guidance*, second edition (WBAG II) (Grafe et al.2002), and will be used on these streams with BURP data collected between 1997 and 2000. Those streams will be assessed for the next §303(d) list. Table 5 lists all streams identified by EPA as perennial. The table also indicates if DEQ has determined the perennial status of the stream. These determinations are based upon observations made by field personnel. This list is for those interested parties that might have data on these streams. Subsequently, those streams added to the §303(d) list would be included in future iterations of the Goose Creek SBA-TMDL.

Table 5. Streams under consideration as perennial streams.

Stream Name	Perennial Status[a]	Stream Name	Perennial Status[a]
Badger Creek	Unknown	Little Cedar Canyon Creek	Unknown
Bear Flat Creek	Unknown	Little Cottonwood Creek	Perennial
Beaverdam Creek	Perennial	Little Goose Creek	Perennial
Big Canyon Creek	Unknown	Little Piney Creek	Perennial
Big Cottonwood Creek	Perennial	Little Squaw Creek	Perennial
Big Rocky Creek	Unknown	Mackey Wash	Unknown
Billys Hole Creek	Perennial	Mill Creek	Perennial
Birch Creek	Perennial	NE Creek	Unknown
Blue Hill Creek	Intermittent	North Carson Creek	Unknown
Boulder Canyon Creek	Unknown	Owens Corral Creek	Unknown
Buck Corral Creek	Unknown	Pickett Spring Creek	Unknown
Cabin Spring Creek	Unknown	Piney Creek	Perennial
Carlson Creek	Ephemeral	Quartz Gulch	Ephemeral
Cave Canyon Creek	Unknown	Right Hand Fork Beaverdam Creek	Ephemeral
Cave Gulch	Unknown	Robber Gulch	Ephemeral

Stream Name	Perennial Status[a]	Stream Name	Perennial Status[a]
Coal Banks Creek	Ephemeral	Rodeo Creek	Ephemeral
Cold Creek	Perennial	Sawmill Creek	Unknown
Coyote Creek	Ephemeral	Smith Creek	Unknown
Devine Canyon Creek	Ephemeral	South Carson Creek	Unknown
Dry Fork Creek	Ephemeral	South Cottonwood Creek	Unknown
Dry Gulch	Ephemeral	South Fork Little Piney Creek	Perennial
East Fork Thoroughbred Creek	Unknown	Spring Creek	Perennial
Ecklund Creek	Unknown	Squaw Creek	Unknown
Elison Hole Creek	Unknown	Summit Creek	Perennial
Emery Canyon Creek	Unknown	Summit Station Creek	Ephemeral
Emery Creek	Perennial	Swanty Creek	Perennial
Fall Creek	Perennial	Terrells Corral Creek	Unknown
Flatiron Creek	Unknown	Thoroughbred Creek	Perennial
Franks Canyon Creek	Unknown	Trapper Creek	Perennial
Goose Creek	Perennial	Trout Creek	Perennial
Humphrey Creek	Unknown	Walker Hollow Creek	Unknown
Jay Creek	Perennial	Walters Creek	Unknown
Lake Creek	Unknown	West Fork Thoroughbred Creek	Perennial
Land Creek	Unknown	Willow Creek	Unknown
Left Hand Fork Beaverdam Creek	Perennial	Wilson Gulch	Unknown
Little Birch Creek	Perennial	Winecup Creek	Intermittent

a Based on DEQ observation.

Goose Creek Reservoir supplies water for irrigation in the northern valley of the subbasin. The reservoir discharges into a main canal, which then splits into two feeder canals, one on the east side of the valley and one on the west side. The Oakley Canal Company provided information on total discharge for the reservoir since 1996. From this data, DEQ estimates that during the irrigation season about 3.45 cubic meters per second (m^3/s) on average are diverted from the reservoir. Monthly and daily discharge rates vary throughout the irrigation season. Typically, peak discharge is in July. Annual discharge from the reservoir, within the data set, appears to have peaked in 1999. Furthermore, a drought period appears to have begun in June, 1999 and has continued through to date as evidenced by the reservoir discharge. The diversion structures for the Goose Creek and Trapper Creek ditches are located approximately 1 km downstream from the reservoir. Limited irrigation water returns exist in the Oakley Valley and northern portions of the subbasin.

Ground Water

Ground water in the Goose Creek Subbasin is an important aspect of the water quality and quantity of some streams. Typically, the streams that lie within the limestone belts of the subbasin are more directly influenced by spring sources than those in the volcanic geological areas. For example, in the Beaverdam Creek and Big Cottonwood Creek areas, springs and dissolved materials in the ground water have a great impact on water quality. In addition, total phosphorus (TP) from ground water affects water quality in Beaverdam Creek. However, for the most, part springs are limited in the subbasin. Some of the springs within the area are warm or hot springs which may influence stream temperatures, although the impact from these geothermal sources is unknown at this time. The Goose Creek-Golden Valley aquifer is the aquifer over which most of the subbasin lies (Figure 4). The elevation of ground water in the Oakley area was estimated to be near 4,000-4,100 feet (ft) above sea level in 1980 (Garabedian 1992). In the Oakley area, this translates to a water table depth of 500-600 ft. However, for most wells in the area, pumping lifts are ordinarily near 400 ft (Young and Newton 1989). The mean specific capacity of wells in Cassia County and the Goose Creek-Golden Valley area is 1,100 gallons per minute per foot (gpm/ft) of draw down. The specific capacity of the count is among the highest in the Eastern Snake River Plain Aquifer, which ranges from 2,120 to 220 gpm/ft (Garabedian 1992). In some areas of the aquifer the transmissivity can be very high, such as in the Quaternary basalts. However, in fine-grained sediments and older tertiary rhyolite the transmissivity is much lower. These factors indicate that time of travel in the lower Goose Creek-Golden Valley area can be very short while in the upper rhyolitic volcanics and sedimentary alluvium areas, time of ground water travel is much longer. Young and Newton (1989) estimated time of travel to be in the area of 9-13 feet per day. Furthermore, typical water movement in the area is from recharge areas in the mountains down gradient towards Murtaugh Lake. The Churchill knobs fault forms a ground water movement barrier that prevents water movement towards Burley and the Snake River.

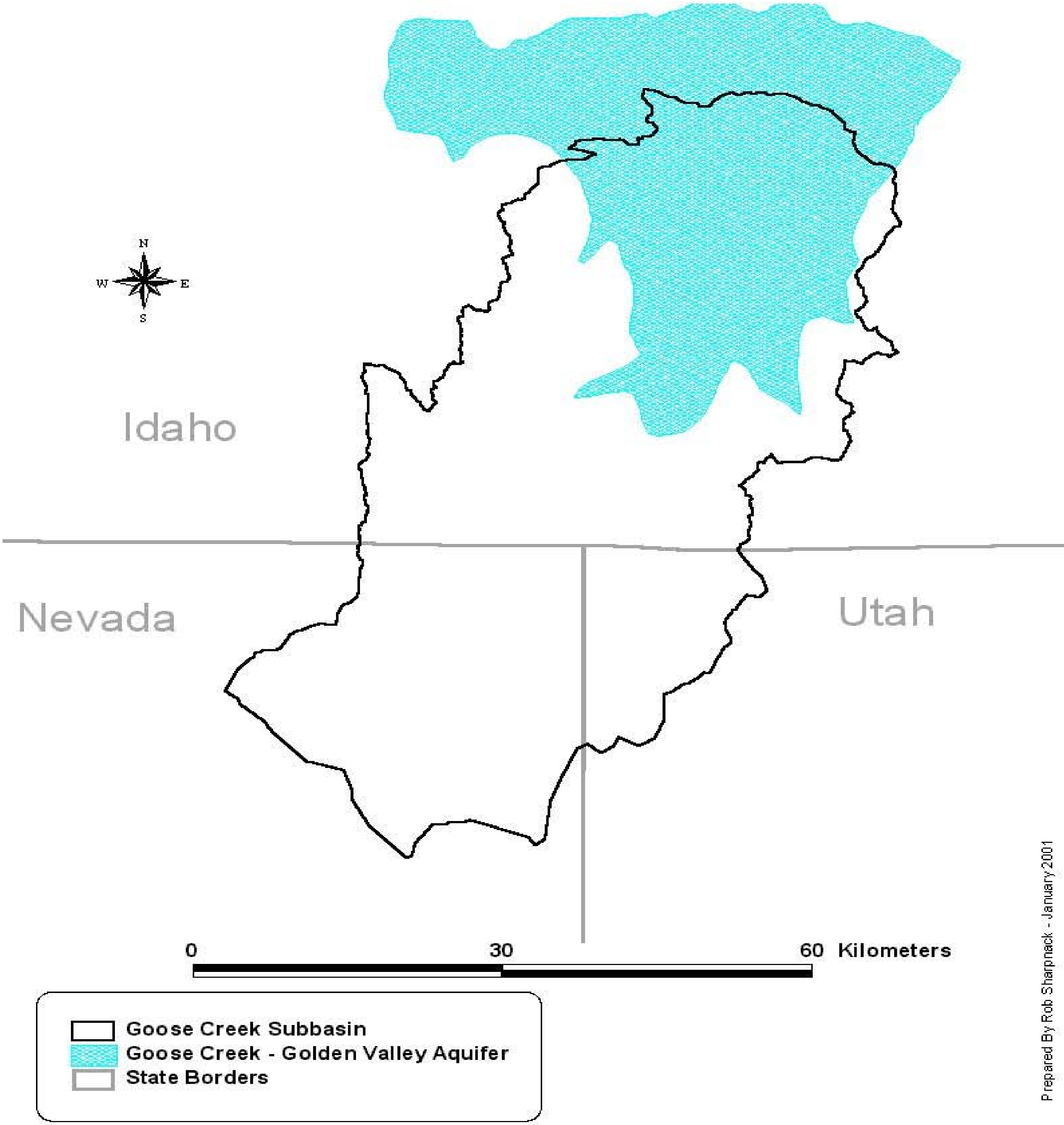


Figure 4. The location of the Goose Creek-Golden Valley Aquifer in relationship to the subbasin.

Some ground water level monitoring was done in the Goose Creek-Golden Valley area (1979 to 1984) to assist in the development of a ground water model (Young and Newton 1989). Most of the monitored wells in the subbasin show a seasonally steady volume of ground water, both predicted and measured, up to the year 1984 (Young and Newton 1989). This may indicate that over the period of record to 1984, recharge and ground water withdrawals have been at equilibrium or at a slight loss. However, some wells have shown steady losses following this period. In general Young and Newton (1989) estimate that ground water declines of 3 to 5 feet annually have occurred. Currently ground water recharge is a topic of great concern in the subbasin. Some ground water recharge projects are underway and others are planned near the lower end of Big Cottonwood Creek. Young and Newton (1989) noted that a substantial amount of ground water recharge occurs from the surface and ground water source irrigation in the Milner Low Lift and Burley Irrigation Districts. Additional recharge is from precipitation and from stream systems in the mountains to the south.

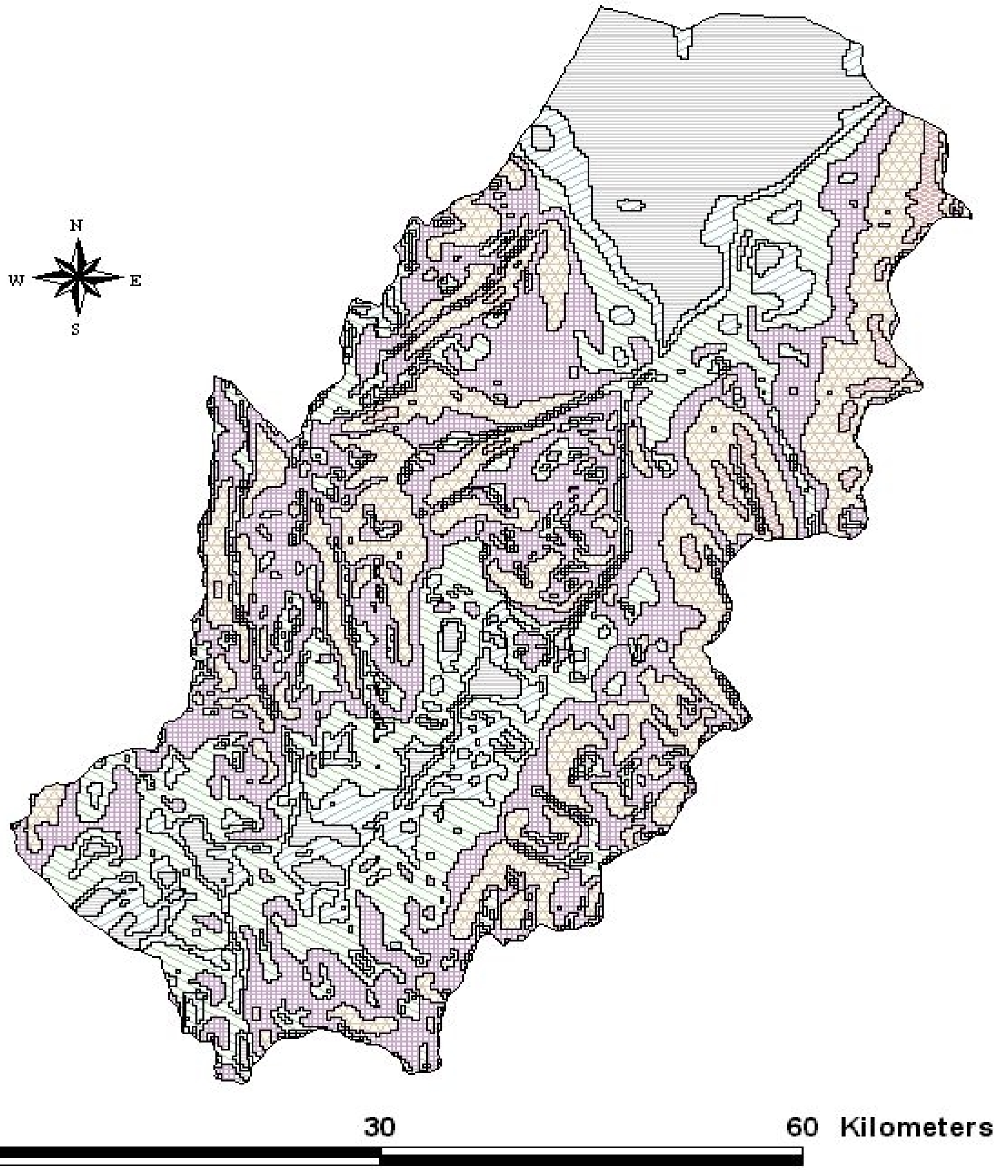
In the aquifer system model analysis done by Young and Newton (1989), they estimated that 390,000 acre/feet per year from ground water and surface water irrigation was recharged to the aquifer. They also noted that only 127,000 to 218,000 acre/feet were removed per year by ground water pumping in the area. Natural springs are another source of recharge loss, and a substantial amount is lost due to evapotranspiration in the non-irrigated lands of the area.

In addition to the Goose Creek-Golden Valley Aquifer, there is a pressurized geothermal layer in the subbasin below the reservoir. Throughout southern Idaho, when the Idavada layer of volcanics exists geothermal activity also exists (Young and Whitehead 1974). The Idavada volcanics are found in the lower portion of the Goose Creek Subbasin (Alt and Hyndman 1989).

Soils/Geology/K-Factor

Local soils can be conceptualized as four soil provinces: the clayey and loamy soils of volcanic areas, the loamy soils of the fluvial canyons, the highly stratified alluvial soils of the area near the town of Oakley, and the alpine glacial soils of the Middle Mountain province.

The average soil slope provides a gauge of potential soil erosion, or risk erodibility. The topographic maps show that slopes are low (0-5 percent) on the agricultural plains and river channel network, moderately steeper in the areas forming the watersheds surrounding this stream network (5-22 percent), and increase appreciably as one approaches the bordering mountain ranges. The slopes are fairly steep in the mountain ranges, ranging from 22-46 percent (Figure 5.).



Slope	Hectares	Sq. Km.	% of Area
Less than 1 %	40,573.5	405.7	14.0
1 to 2 %	29,353.4	293.5	10.1
2 to 5 %	68,999.6	690.0	23.7
5 to 10 %	91,005.6	910.1	31.5
10 to 22 %	55,718.8	557.2	19.2
22 to 46 %	4,596.1	46.0	1.6

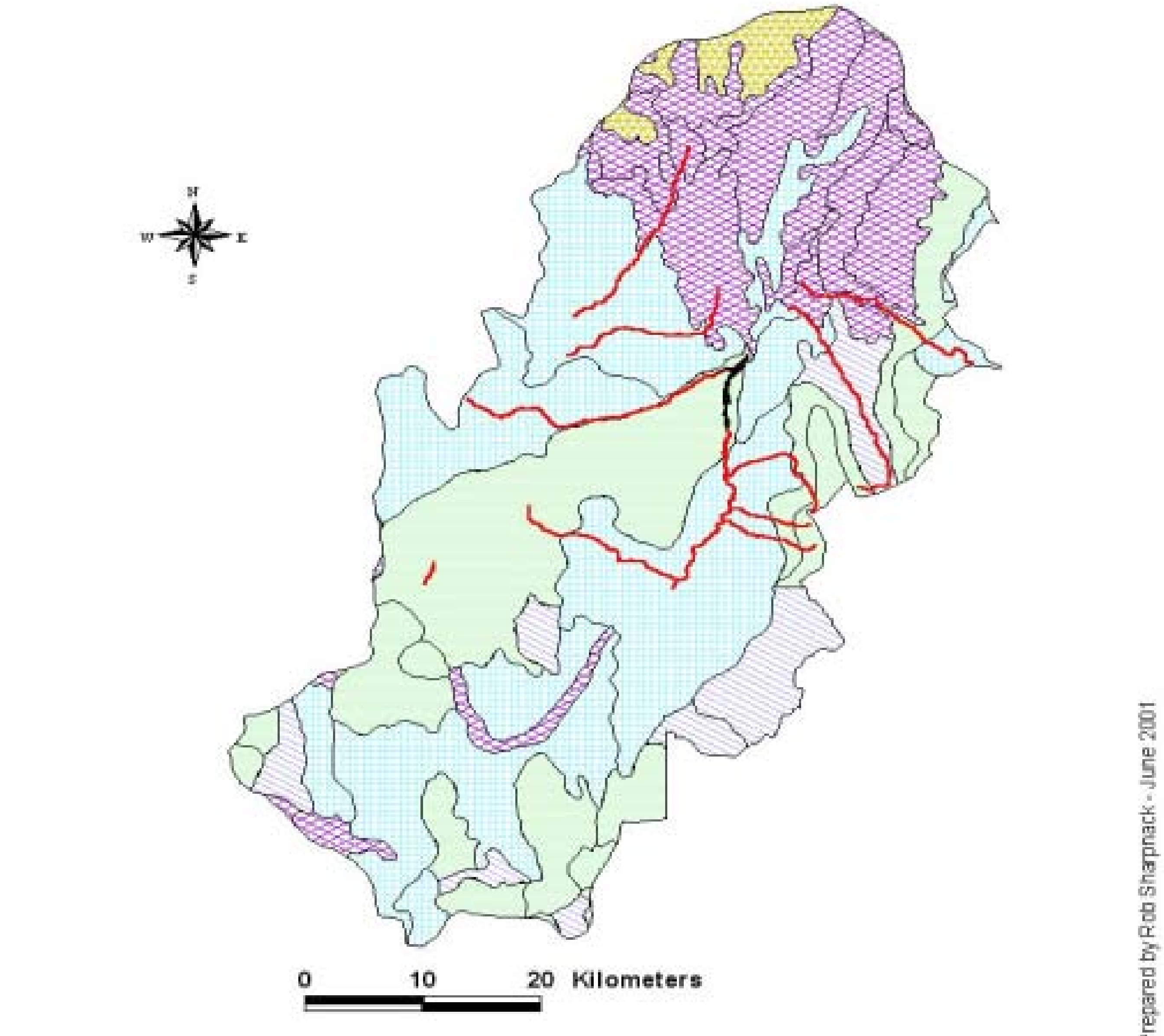
Figure 5. Slope classes of the Goose Creek Subasin.

The "K-factor" is the soil erodibility factor in the Universal Soil Loss Equation (Wischmeier and Smith 1965). The factor is comprised of four soil properties: texture, organic matter content, soil structure, and permeability. The K-factor values range from 1.0 (most erosive) to 0 (nearly non-erosive). K-factors for the Goose Creek Subbasin were calculated from the EPA BASINS (http://www.epa.gov/OST/BASINS/) soil information and range from 0.098 to 0.495. This indicates that the soils in the subbasin are relatively stable with the highest K-factor at nearly the mid point between highly erodible and nonerosive. Soils on the flat slope of the plains and agricultural areas have the most erodible soils, with K-factors that range from 0.3 to 0.495. The K-factors range from 0.209 to 0.3 on the soils of the main rangeland areas, such as in the Goose Creek and Trapper Creek Canyons. On the slopes forming the stream network of eastern watersheds, the erosion potential is low, with K-factors ranging from 0.098 to 0.3. See Figure 6 for area weighted K-factors of the Goose Creek Subbasin soils.

In general, the K-factors indicate that the rangeland have low soil erosion potentials. Because of this, the amount of sediment from rangeland entering streams is also low. Due to the low erosion potential from the uplands, the Goose Creek SBA and following Total Maximum Daily Loads (TMDL) will focus on valley bottom and channel sources of sediment for those streams on the 1998 §303(d) list with sediment as a pollutant.

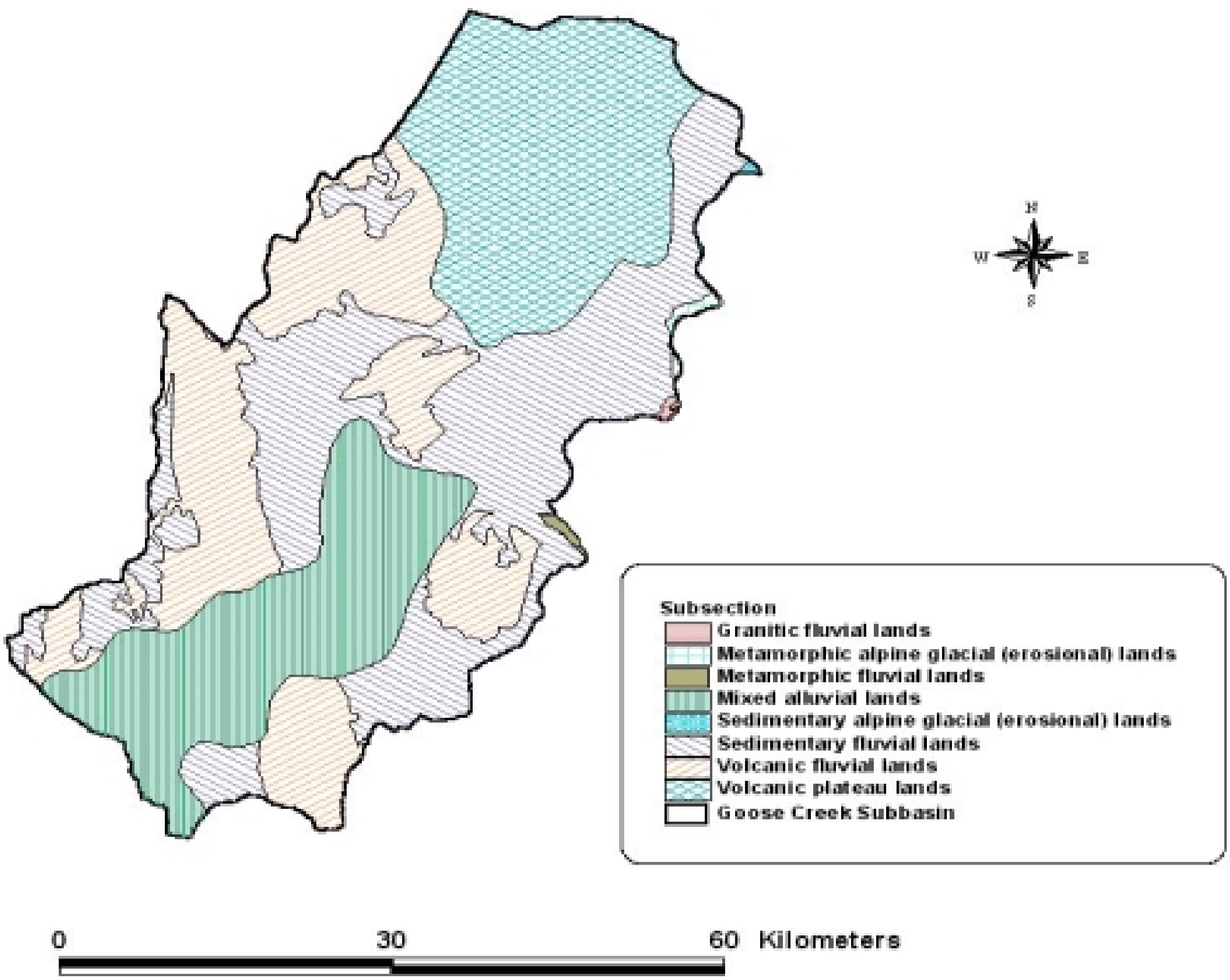
The overall geologic structure of the area is within the southern extent of the Northern Basin and Range ecoregion. The Basin and Range is an area of faulted metamorphic and sedimentary rocks uplifted into mountains, separated by basins deeply filled with alluvium and colluvium. In addition, areas of the Goose Creek Subbasin that lie within the Northern Basin and Range contain granitic intrusions in scattered locations. Also prominent in the ecoregion, beside the volcanic geology common to southern Idaho, are the Pliocene and Miocene lake and stream deposits through which Trapper, Goose, and Beaverdam Creeks flow (Geology from ArcView shapefile).

The Snake River Basin/High Desert ecoregion crosscuts the Goose Creek Subbasin in the north. Locally thick deposits of loess (wind-blown silt) overlie these rocks, particularly in the volcanic Snake River Plain (Alt and Hyndman 1989). The Snake River Plain is a deep, wide, structural basin filled with a veneer of volcanic basalt deposits overlying rhyolite. The rocks in the Snake River Plain decrease in age, from west to east, due to the migration of a magma source that has migrated to present-day Yellowstone National Park.



K-Factor Classes	Hectares	Sq. Kilometers	% of Area
0.098 - 0.134	85,788.9	857.9	28.2
0.134 - 0.209	24,615.0	246.1	8.1
0.209 - 0.300	119,026.2	1,190.3	39.1
0.300- 0.394	67,551.3	675.5	22.2
0.394 - 0.495	7,326.9	73.3	2.4

Figure 6. Soil erosion index and location of water quality limited streams within the subbasin.



Source: White Horse Assoc. 1999

Subsection	Hectares	Sq. Kilometer	% of Area
Granitic fluvial lands	294.3	2.9	0.1
Metamorphic alpine glacial (erosional) lands	964.5	9.6	0.3
Metamorphic fluvial lands	501.6	5.0	0.2
Mixed alluvial lands	54,202.9	542.0	18.7
Sedimentary alpine glacial (erosional) lands	231.3	2.3	0.1
Sedimentary fluvial lands	96,946.8	969.5	33.4
Volcanic fluvial lands	72,450.6	724.5	25.0
Volcanic plateau lands	64,658.0	646.6	22.3

Prepared by Rob Sharpnack - April 2001

Figure 7. Major geological subdivisions of the Goose Creek Subbasin.

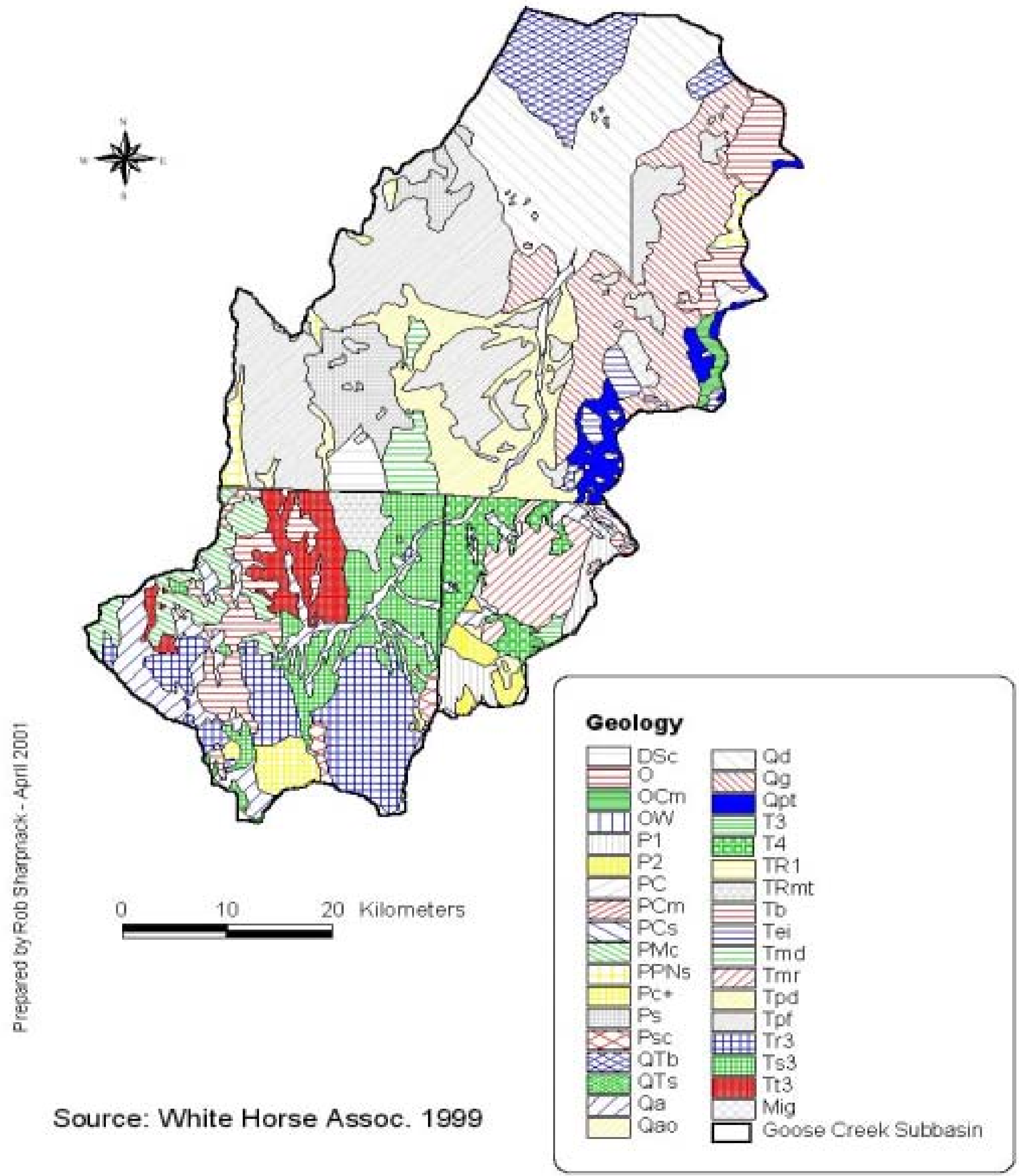


Figure 8. Geological formations within the Goose Creek Subbasin.

Table 6. Geologic description for various formations

Formation	Goose Creek Subbasin Geologic Descriptions
Ms	Mississippian shallow-water coralline limestone interval of southern Idaho
O	Ordovician marine dolomite quartzite and limestone
OCm	Schist quartzite and other metasediments of probable Lower Ordovician
OW	Open Water
PC	Precambrian high-grade metamorphic rocks
PNs	Pennsylvanian beds; lowermost portion of southern Idaho sequence
PPNs	Lower Permian to Middle Pennsylvanian chert limestone and sandstone
PZu	Upper Paleozoic marine sediments in southern Idaho
Ps	Lower Permian beds; uppermost portion of southern Idaho sequence
QTb	Lower Pleistocene to Pliocene basalts with associated tuffs and volcanic detritus
Qa	Quaternary alluvium
Qd	Quaternary detritus
Qg	Quaternary colluvium fanglomerate and talus
Qpt	Pleistocene till moraines and similar unsorted glacial debris
Qpu2b	Upper Pleistocene Snake Plain lava flows
Qs	Quaternary surficial cover
TR	Triassic shallow-marine to non-marine sediments of eastern Idaho
Tei	Eocene intrusions
Tpd	Pliocene stream and lake deposits
Tpf	Pliocene silicic welded tuff ash and flow rocks
Tpv	Pliocene volcanic units

*GIS coverage changes at state lines due to different state descriptions for geological types.
Various agencies are working to have the descriptions the same for all areas.

The geomorphology of the subbasin can be divided into four main geological subsections (Figure 7). Within each of these subsections, locally distinct geological formations can be found. The majority of the subbasin (33.4 percent including the Utah and Nevada portions) lies within the sedimentary fluvial subsection. Each geological subsection contributes sediment to the streams in various volumes. From Figures 6 and 7 it can be seen that the volcanic plateau subsection (22.3 percent of the subbasin) likely does not contribute significant sediment loads to the streams and rivers as its slopes are usually less than 5 percent and it is below Goose Creek Reservoir. Therefore, only three geological subsections play any factor in water quality in the Goose Creek Subbasin.

For a more complete discussion of the geology of the Goose Creek Subbasin Figure 8 and Appendix B (Geology of the Goose Creek Subbasin) contributed by Carl Austin, a local area geological expert.

Topography

The region is cartographically covered by 1:24,000-scale and higher USGS topographic quadrangle maps. The total vertical relief in the area is 2,019 m, from an elevation of 1,284 m near the town of View (the closest town to the northern boundary; View is outside of the subbasin by approximately 4.5 km) to 3,303 m in the Albion Mountains (Mount Independence). Slopes in the agricultural areas are quite gentle (less than 1 percent) with considerably steeper slopes in the foothills and mountains (5-46 percent) (Figure 5).

The topography is an expression of the geologic structure and historical glacial and volcanic processes. Chiefly the faulted, linear mountain chains of the Northern Basin and Range ecoregion, which are bordered by the Snake River Plain to the north, are the basis for most of the topography. The mountainous areas of the subbasin can be generally broken into several provinces. The first of these are low volcanic (rhyolite) mountains in the Big and Little Cottonwood Creek areas. Second are the limestone Albion Mountains from which spring sources dominate and form Mill Creek and Summit Creek. Third are the granitic intrusions and quartzite Middle Mountain upon which Blue Hill, Cold, and Emery Creeks are formed. Next are the limestone and very old lake and ocean deposits found in the Beaverdam Creek area. The final province is made of basalts and quaternary detritus, which form the fertile agricultural Snake River Plain area (Figure 8).

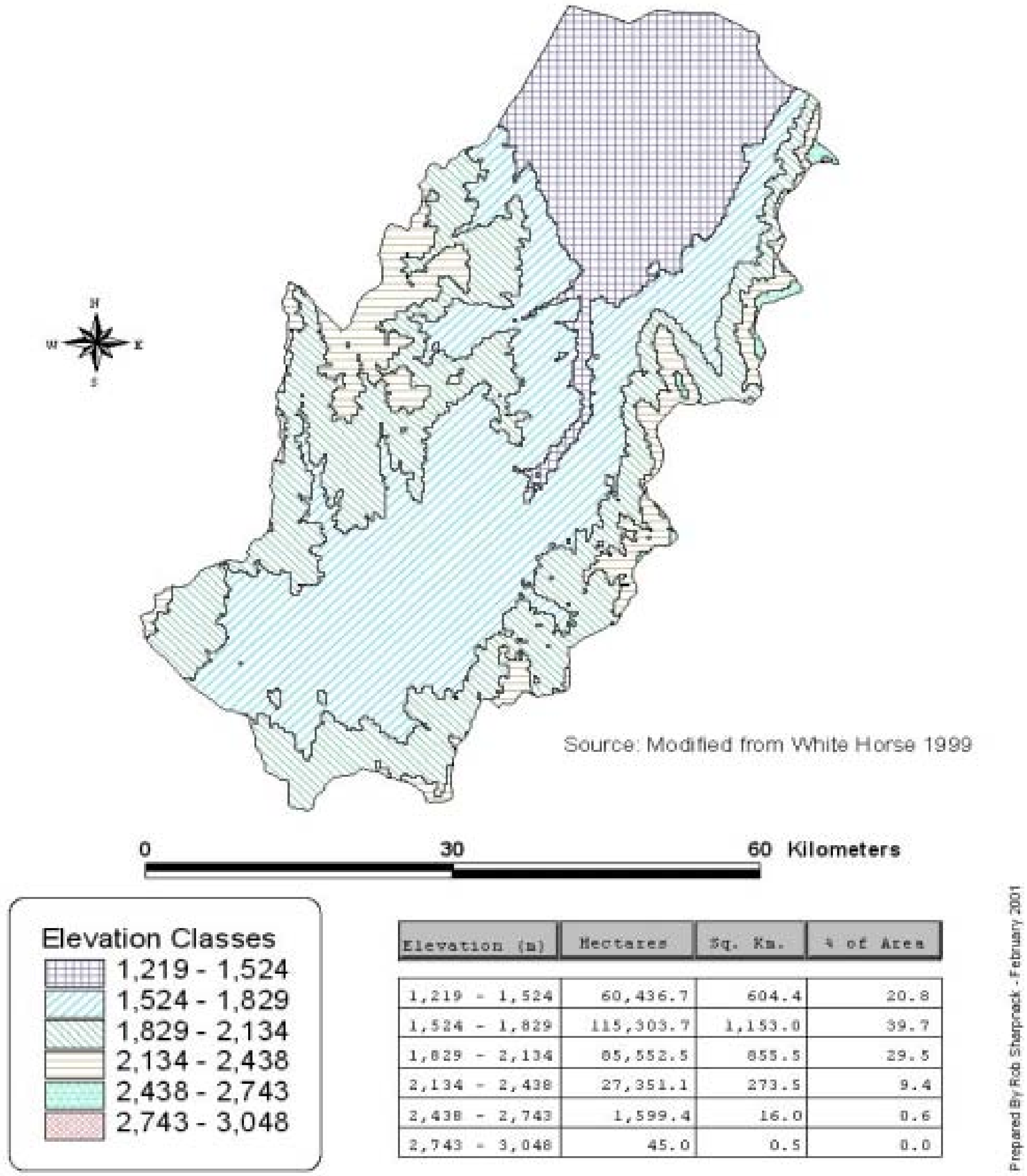
The Goose Creek and Trapper Creek streams bisect the subbasin and flow through small open valleys. Alluvial terraces rise above these streams along their courses. The town of Oakley sits within the alluvial fan of these streams.

Elevation

The Goose Creek Subbasin covers approximately 2,902 square kilometers (km^2) in total area. Nearly 1,791 km^2, or 62 percent of the subbasin, lies within the state of Idaho. The elevation range within the Idaho portion of the subbasin is from 1,219 to 3,048 m. The average elevation of the entire subbasin is approximately 1,600-1,900 m (Figure 9). The entire subbasin slope range is from less than 1 percent to 46 percent. The average subbasin slope is approximately 4.4 to 9.6 percent. Generally, the stream bottoms have slopes of less than 2 percent, while the mountains have slopes 5 to 22 percent. Overall, the subbasin has a northeast aspect. The stream channels and mainstem rivers follow a dendritic drainage pattern throughout the subbasin. In the subbasin, there are 569.77 km of perennial streams, 1951.92 km of ephemeral and intermittent streams, and 352.15 km of canals and ditches (Table 7). Roughly, 61 percent of the perennial streams are located within the area of the subbasin located in Idaho. Approximately 76 percent of the intermittent and ephemeral streams are located in this same area.

Table 7. Elevation ranges of the different water body types in the Goose Creek Subbasin.

Elevation Range (meters)	1,219-1,524	1,525-1,829	1,830-2,134	2,135-2,438	2,439-2,743	2,744-3,048	Subbasin Total	Percent in Subbasin
Water Body Type	***Kilometers***							
Ditch	342.75	6.95	2.45	0	0	0	352.15	12.1
Intermittent and Ephemeral Streams	409.53	989.11	483.30	67.68	2.30	0	1,951.92	67.3
Intermittent Shoreline	1.63	0	0	0	0	0	1.63	0.06
Shoreline	24.00	0	0	0	0	0	24.00	0.83
Perennial Streams	77.69	269.88	180.57	39.96	1.67	0	569.77	19.7
Total	855.60	1,265.94	666.32	107.64	3.97	0.00	2,899.47	99.99



Elevation (m)	Hectares	Sq. Km.	% of Area
1,219 - 1,524	60,436.7	604.4	20.8
1,524 - 1,829	115,303.7	1,153.0	39.7
1,829 - 2,134	85,552.5	855.5	29.5
2,134 - 2,438	27,351.1	273.5	9.4
2,438 - 2,743	1,599.4	16.0	0.6
2,743 - 3,048	45.0	0.5	0.0

Figure 9. Elevation ranges of the Goose Creek Subbasin.

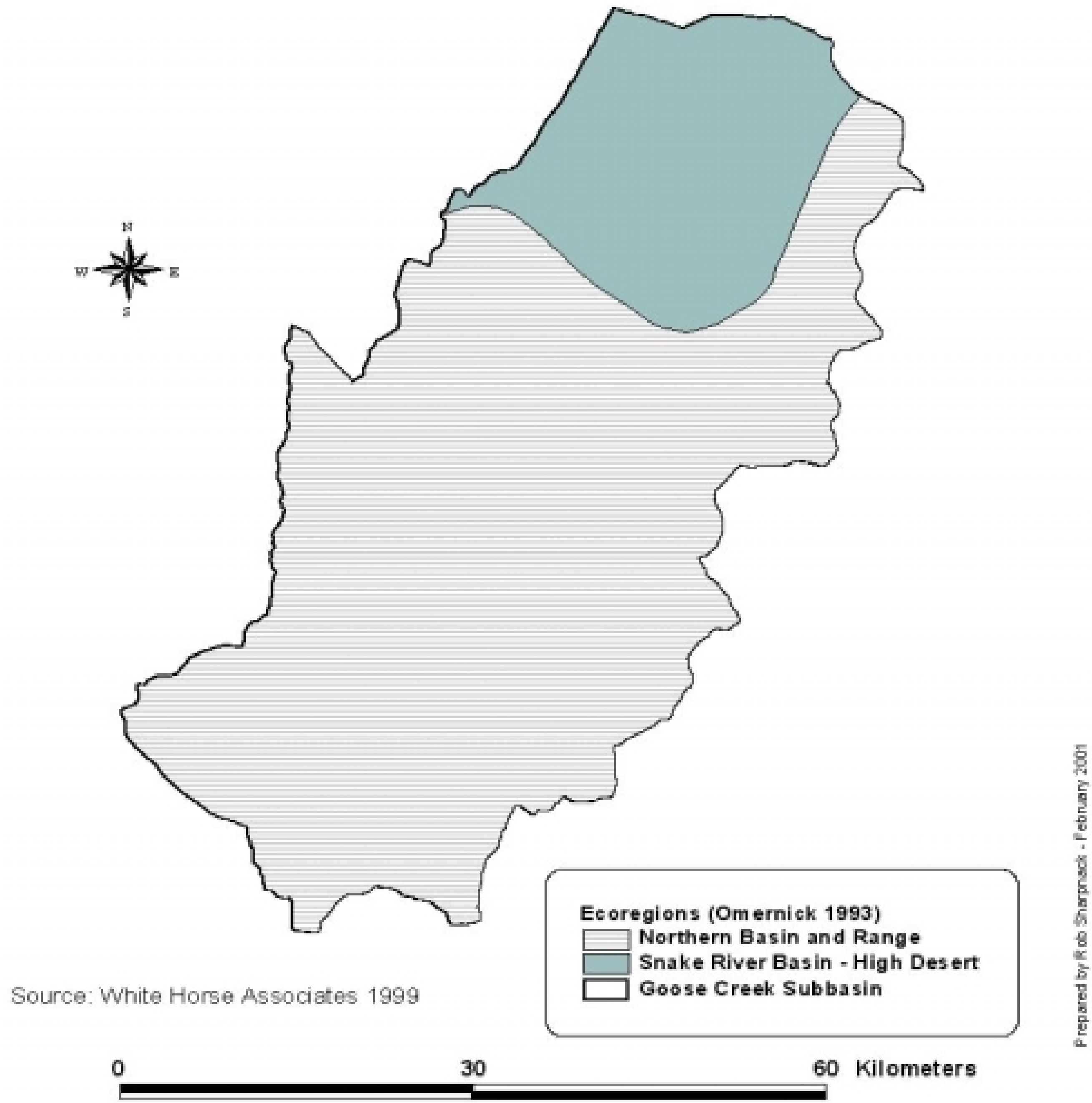
Vegetation

The Goose Creek Subbasin is predominantly within the Northern Basin and Range ecological region (79.4 percent of the subbasin) as described by Omernik and Gallant (1986) and Omernik (1986), with a small area of Snake River Basin/High Desert in the north (Figure 10).

Sagebrush/wheatgrass/needlegrass steppe is the dominant vegetation type throughout the region. Large tracts of juniper are also found in this area; although, recent, large-scale fires have removed significant portions of the juniper community in many of the watersheds. Saltbrush and greasewood are also found within the subbasin. Streamside vegetation is generally the same as the surrounding regional vegetation due to the intermittent or ephemeral nature of most streams. Where perennial flow does occur, dense stands of sedges and forbs line the riparian zone. In perennial streams with moderate annual flow, woody vegetation consists of alder, willow, cottonwood, clematis, rose, and mock orange.

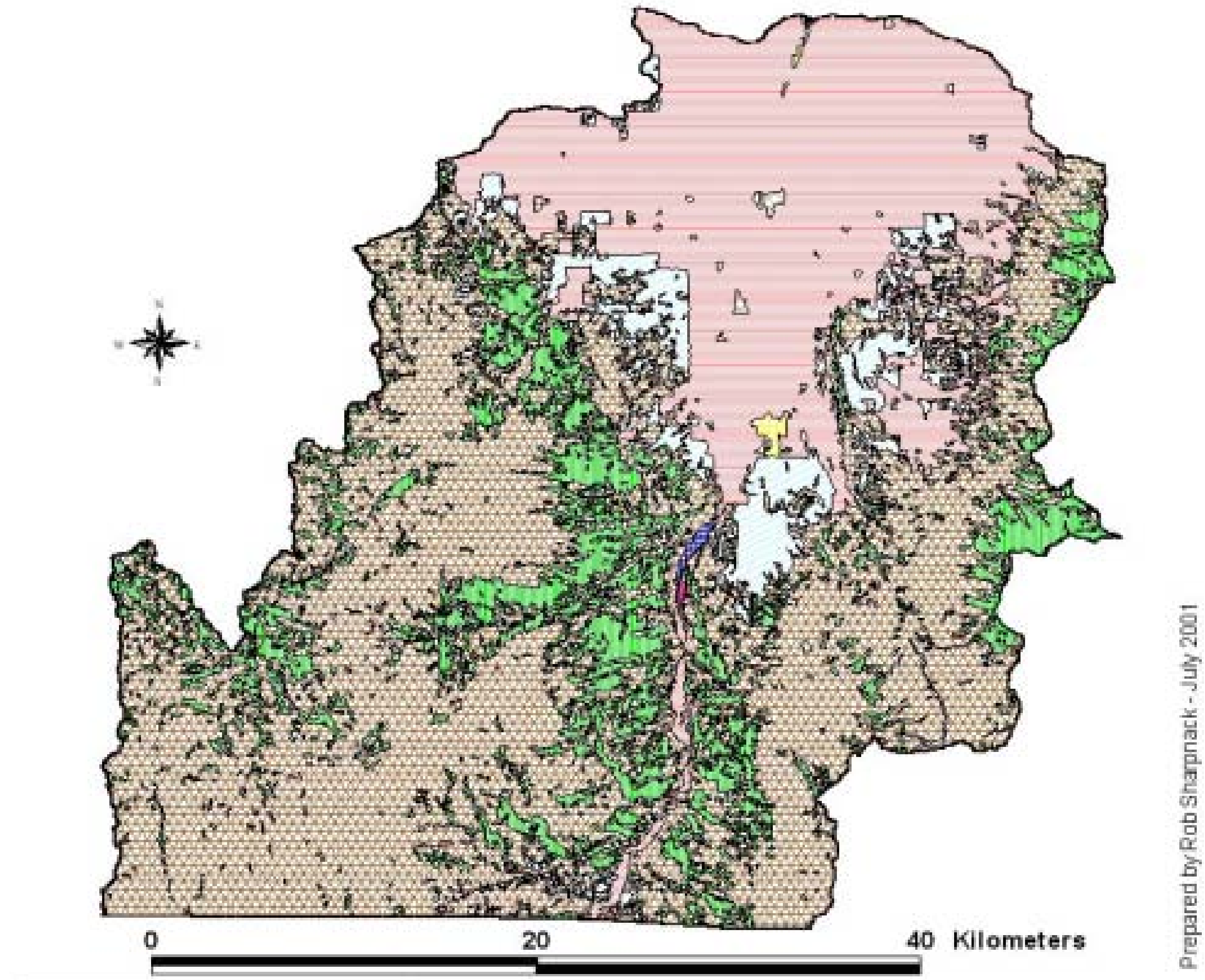
Most of the Northern Basin and Range ecoregion (Figure 10) is used as rangeland. However, some areas within basins or bordering large streams are irrigated for pasture. Where access by livestock is concentrated, loss or reduction of streamside vegetation is severe causing stream bank erosion and sedimentation. Water withdrawal for pasture irrigation or stock water can result in completely dry channels downstream from diversions.

Variability in the makeup of natural vegetation in the Goose Creek Subbasin is minimal. Shrubland vegetation predominates the entire subbasin (54.2 percent in the Idaho portion) with limited riparian vegetation (0.5 percent of the Idaho portion of the subbasin) in the mainstem streams and rivers. Following the construction of irrigation canals and irrigation return drains, some of the natural sage-grass areas have been changed to support agricultural crops, pasture grasses, hay, and riparian vegetation (Figure 11).



Ecoregion	Hectares	Sq. Km	% of Area
Snake River Basin - High Desert	59,853.1	598.5	20.6
Northern Basin and Range	230,396.9	2,304.0	79.4

Figure 10. The two ecoregions of the Goose Creek Subbasin.



Description	Hectares	Sq. Kilometer	% of Area
Urban/Developed	349.0	3.5	0.2
Agriculture	44,238.7	442.4	24.1
Grassland	11,941.7	119.4	6.5
Shrubland	99,884.1	998.8	54.3
Forested	26,222.6	262.2	14.3
Water	170.9	1.7	0.1
Riparian	867.0	8.7	0.5
Wetlands	78.7	0.8	0.0
Barren/Rock	2.7	0.0	0.0

Figure 11. Vegetation classes within the Idaho portion of the Goose Creek Subbasin.

Fish and Wildlife

Within the Goose Creek Subbasin there are several state and federal agencies that list species of special concern; candidate species; or endangered, threatened, and sensitive species. The United States Fish and Wildlife Service (USFWS) is the main (non-anadromous, nonmarine species) listing agency. The USFWS lists 21 animals and 3 plants as endangered, threatened, or as candidate species within the state of Idaho (*http://ecos.fws.gov/webpage/webpage_region_lists.html?lead_region=1*). However, in Cassia County there are only seven endangered or threatened species with two additional candidate species (Table 8). Of these nine species, four are aquatic, and one is a semiaquatic plant. Three of the animals are snails, which are found only in the mainstem of the Snake River and as such are not influenced by activities within the Goose Creek Subbasin. Therefore, the only federally listed aquatic plants and animals that will be influenced by the SBA or TMDL are the spotted frog (*Rana luteiventris*) and the Ute ladies'-tresses (*Spiranthes diluvalis*). The Ute ladies'-tresses has the potential to be found in wet meadows, along riparian zones, and in other wetlands (USFS 2001). The spotted frog is an aquatic animal found in and near streams, lakes, marshes, and ponds. The spotted frog frequents these aquatic habitats in mixed coniferous forests, subalpine forests, grasslands, and sage and rabbitbrush shrublands (Stebbins 1985). Management decisions, as a result of the SBA-TMDL, should address these two species and may affect upland species as well. These should be addressed in any implementation plans developed by state and federal land management agencies.

There is only one threatened species (bald eagle), no endangered species, and only one candidate species (yellow-billed cuckoo), that need to be considered in any planning efforts and management decisions by the BLM Burley Field Office. This is in accordance with the most recent official species list (1-4-03-SP-283) received from the U. S. Fish and Wildlife Service on June 3, 2003.

In addition to the listed and candidate species, the United States Forest Service (USFS) through the USFWS, maintains a list of species of interest, or watch species. These plants and animals are those that are not listed but that the USFWS suggests that federal agencies consider in the management and planning activities. The Sawtooth National Forest contains 44 species found on this list.

The Idaho Department of Fish and Game (IDFG) maintains a statewide list of species of special concern. Many of the species on this list are duplicates of those listed by the USFWS and other federal agencies. However, the list does not contain plant species. Table 8 displays the federally listed threatened, endangered, and federal species of special concern found within the Goose Creek Subbasin. A list of the Idaho Department of Fish and Game's species of special concern can be found at *www2.state.id.us/fishgame/info/nongame/ngconcern.htm*.

Table 8. Threatened, endangered, and other species of federal concern in the Goose Creek Subbasin.

Species Common Name	Scientific Name	Comments
Spotted Frog	*Rana lateiventris*	Considered the Great Basin sub-populations of the Columbian spotted frog. Determined that listing was warranted 1993. Currently a candidate species.
Ute Ladies'-Tresses	*Spiranthes diluvialis*	Recognized as a distinct species in 1984. Listed as threatened in 1992.
Canada Lynx	*Lynx canadensis*	Proposed for listing as threatened.
Gray Wolf	*Canus lupus*	Currently listed as endangered.
Bald Eagle	*Haliaeetus leucocephalus*	First protected in 1966 by the Endangered Species Preservation Act. Listed in 1973 under the Endangered Species Act. Down-listed from endangered to threatened in 1995.
Utah Valvata Snail	*Valvata utahensis*	Listed as endangered in 1992.
Snake River Physa Snail	*Physa natricina*	Listed as endangered in 1992.
Bliss Rapids Snail	*Taylorconcha serpenticola*	Listed as threatened in 1992.
Christ's Paintbrush	*Castilleja christii*	Candidate species.
Yellow-billed Cookoo	*Coccyzus americanus*	July 2001, USFWS published findings that indicated the yellow-billed cookoo should be listed. Other priorities preclude this listing; therefore, it is considered a candidate species. (This information is not on current USFWS Web site listed on pg. 23)

Fisheries

There are many species of fishes in the streams and reservoirs of the Goose Creek Subbasin (Table 9). The various fish species found within the basin include rainbow trout, brown trout, brook trout, cutthroat trout, cutthroat/rainbow trout hybrid, kokanee salmon, sculpin species, shiners, long nose dace, speckled dace, and sucker species such as Utah, mountain, and blue head suckers.

Table 9. Fish species and pollution tolerance in the Goose Creek Subbasin

Species	Scientific Name	Tolerance to Pollution[a]
Yellowstone cutthroat trout	*Oncorhynchus clarki bouvieri*	II
Rainbow trout	*Oncorhynchus mykiss*	II
Brown trout	*Salmo trutta*	MI
Brook trout	*Salvelinus fontinalis*	MI
Cutthroat/rainbow hybrid	*Oncorhynchus clarki X O. mykiss*	II
Kokanee salmon	*Oncorhynchus nerka*	II
Sculpin	*Cottus sp.*	
Utah sucker	*Catostomus ardens*	TT
Mountain sucker	*Catostomus platyrhychus*	MT
Shiners	*Richardsonius sp.*	
Longnose dace	*Rhinichthys cataractae*	MI
Specked dace	*Rhinichthys osculus*	MI
Leatherside chub	*Gila copei*	MT
Spottail shiner	*Notropis hudsonius*	
Walleye	*Stizostendion viteum*	MT

a From: *1996 Water Body Assessment Guidance, A Stream to Standard Process* (DEQ 1996)
Tolerance Value: II = Highly intolerant, MI = Moderately intolerant, MT = Moderately tolerant, TT = Highly tolerant

In addition, DEQ has recently developed a fish index for assessing water bodies for upcoming §303d lists. The stream fish index is part of WBAG II (Grafe et al. 2002) document and uses the fish community to determine the support status of cold water aquatic life. The individual metrics within the index are slightly different depending upon which ecoregion the stream falls within. For rangeland type streams the metrics used were percent cold water individuals, Jaccard’s community similarity coefficient, percent omnivores and herbivores, percent cyprinids as longnose dace, percent of fish with abnormalities, and catch per unit effort.

Macroinvertebrates

DEQ has developed two multi-metric indices for macroinvertebrate communities over the past decade. Both share many of the same metrics, plus there are metrics unique to each. The first of these was developed in 1996 as part of the original WBAG. It was called the macroinvertebrate biotic index (MBI) and was intended to be used as an indicator of stream health (DEQ 1996). The MBI assessed the status of aquatic life beneficial uses primarily in wadeable streams in Idaho. Seven metrics (measures of certain aspects of the macroinvertebrate community structure based upon the species present and their relative abundance) were combined. These metrics were normalized by calculating the ratio to their ecoregion benchmarks (thus giving equal weight to each with a maximum score of 7), and then summed. The macroinvertebrate community, and the water body in which it resides, was considered impaired if the MBI score was less than or equal to 2.5. With a score greater than or equal to 3.5, the water body was considered not impaired, or in good health. Values between 2.5 and 3.5 were considered inconclusive, and required verification before the status of the beneficial uses could be determined.

Following the development of WBAG II, a new multi-metric tool was used to assess the aquatic life beneficial uses of wadeable streams in Idaho (Grafe et al. 2002). DEQ staff and Tetra Tech, a private consulting firm often employed by the EPA, developed the new tool. The new macroinvertebrate tool is called the Stream Macroinvertebrate Index (SMI). Within the index nine metrics are used: total taxa, Ephemeroptera taxa, Plecoptera taxa, Trichoptera taxa, percent Plecoptera, Hilsenhoff Biotic Index, percent five dominant taxa, scraper taxa, and clinger taxa. Further descriptions of scoring and breakpoint determinations can be found in WBAG II (Grafe et al. 2002). Theoretically, the SMI yields scores that range from 0 to 100. Break points used to assign rating conditions were based on reference conditions found in desert basin streams. These break points and condition ratings allow DEQ to integrate the scores from other indices into one final score for a given stream. The condition ratings range from 0, the minimum threshold, to 3, the maximum rating a stream can receive. The condition ratings from all indices used in an assessment are averaged to determine the final assessment outcome. For the desert basin ecoregions a SMI score greater than or equal to 51 yields a condition rating value of 3. For scores less than 33 a condition rating value of 0 is given. In general, if a stream receives an average condition rating of 2 or more it would be considered fully supporting its beneficial uses.

For the Goose Creek SBA, DEQ assessed the macroinvertebrate communities using both multi-metric indices in conjunction with other biological communities and water chemistry. These other data sources will augment any perceived shortcomings of the MBI and SMI in assessing the status of aquatic life beneficial uses in streams in the Goose Creek Subbasin. Moreover, the use of the macroinvertebrate community will lend further weight to fishery and water chemistry assessments made in previous and following sections. The assessment of the macroinvertebrate information will be based on the WBAG II, corroborating information from other sources, and the best professional judgment of DEQ staff involved with the collection and assessment of this type of data.

Aquatic Vegetation

Throughout the spring and summer of 2001, DEQ conducted water quality monitoring on the §303(d) listed water bodies within the Goose Creek Subbasin. During these monitoring events, DEQ made other water quality observations. These included the number and type of fishes observed and the approximate dates the various streams in the subbasin went dry. In addition to these observations, DEQ has noted the distribution of aquatic plants in the streams. Most locations are completely devoid of aquatic plant mats that would indicate excessive aquatic growths due to excess nutrients. In other locations the aquatic plants are localized and do not cover large portions of the streambeds. In addition, DEQ has not received any complaints concerning aquatic vegetation within the subbasin.

1.3 Cultural Characteristics

The cultural characteristics of the Goose Creek Subbasin have not changed dramatically since members of the Church of Jesus Christ of Latter Day Saints first settled the area. The area's first inhabitants arrived in 1879-80. In the following years, several hundred people were living in the Oakley area. Later the area would boast a population of nearly 2,000 after several mines were opened (Hedberg 1993). Meanwhile, water projects, such as the Milner Dam and the Minidoka Dam, were beginning to be built in surrounding communities. These large water projects assured the surrounding areas of a steady supply of water in areas where water was limited. Consequently, the communities flourished. In 1909, developers from the east decided to build a dam in the Oakley area. The idea of a steady flow of water for the Oakley area was appealing, and the local paper was predicting that in 10-20 years following the completion of the dam there would be 10,000-30,000 people living in the Oakley area (Hedberg 1993). However, the water quantity stored by the dam did not live up to its original billing. The Oakley area now supports a small farming community of nearly 1,000 people.

Land Use

As seen in Figures 12 and 13 and Table 10, 42 percent of the lands within the Idaho portion of the subbasin are considered rangeland (according to GIS maps). Nearly all the remaining lands are in open agricultural areas, which are classified as irrigated agriculture. Goose Creek has been legally declared nonexistent in this area. A very small portion of the subbasin is classified as urban (4.2 percent). The urban areas are scattered in the agricultural areas and are made up of many small town sites that range in size from Oakley (population 600-700) to Trout (population 1-10). A portion of the subbasin is forested, but rangeland activities predominate in those areas as well. While about 42 percent of the subbasin is considered range, in actuality about 62 percent of the Idaho portion of the subbasin is used as rangeland.

Table 10. Land use in the Goose Creek Subbasin (Idaho portion only).

Land Use Type	Area, km^2	Percent of Total Area
Range	754.1	42.1
Forest	449.5	25.1
Irrigated Agriculture	512.2	28.6
Urban	75.2	4.2
Total	1791.0	100.0

Highway 27 is the main road through the subbasin. This highway crosses the northern-most portions of the subbasin and heads southbound down the eastern portion of the subbasin. The only other paved roads in the subbasin are those that connect the small towns in the area and the section roads out of Oakley and Burley. The remainder of the subbasin is covered with numerous dirt and gravel roads, most of which are not maintained (Figure 14).

Land Ownership, Cultural Features, and Population

The Idaho portion of the subbasin lies almost entirely within Cassia County (Figure 15). Privately owned lands (28.90 percent of the entire subbasin) are essentially the same lands that are used for agriculture. The majority of the remainder (68.12 percent of the subbasin) is managed by the federal government (United States Bureau of Land Management [BLM] 42.84 percent and USFS 25.28 percent). Scattered state endowment lands (sections 16 and 36), under the management of Utah, Idaho, and Nevada's respective department of lands, comprise 2.85 percent of the subbasin.

The population in Cassia County was 19,532 in 1990 (www.idoc.state.id.us 2000) and 21,416 in 2000. The majority of the county population lives outside of the subbasin. For example, the population of several of the cities near the subbasin (Burley, Declo, Albion, and Malta) was 10,093 in 2000. Most of the towns in the subbasin are too small to be listed here. The largest municipality in the subbasin is the town of Oakley (population 668). Other small towns in the subbasin include Basin, Trout, and Marion (Figure 15). The underlying foundation for economic activity in the area is agriculture, which consists of ranching and farming. Decreed stock watering rights began in 1872, while decreed surface water rights for irrigation in the subbasin began in 1875.

Recreation is an important water-related industry of the Goose Creek Reservoir, although water delivery for irrigation is the principle use for the reservoir's water. This impoundment provides for recreational experiences throughout the year, most notably fishing for trout and walleye. In addition to fishing, personal watercraft use and water skiing occur on a limited basis.

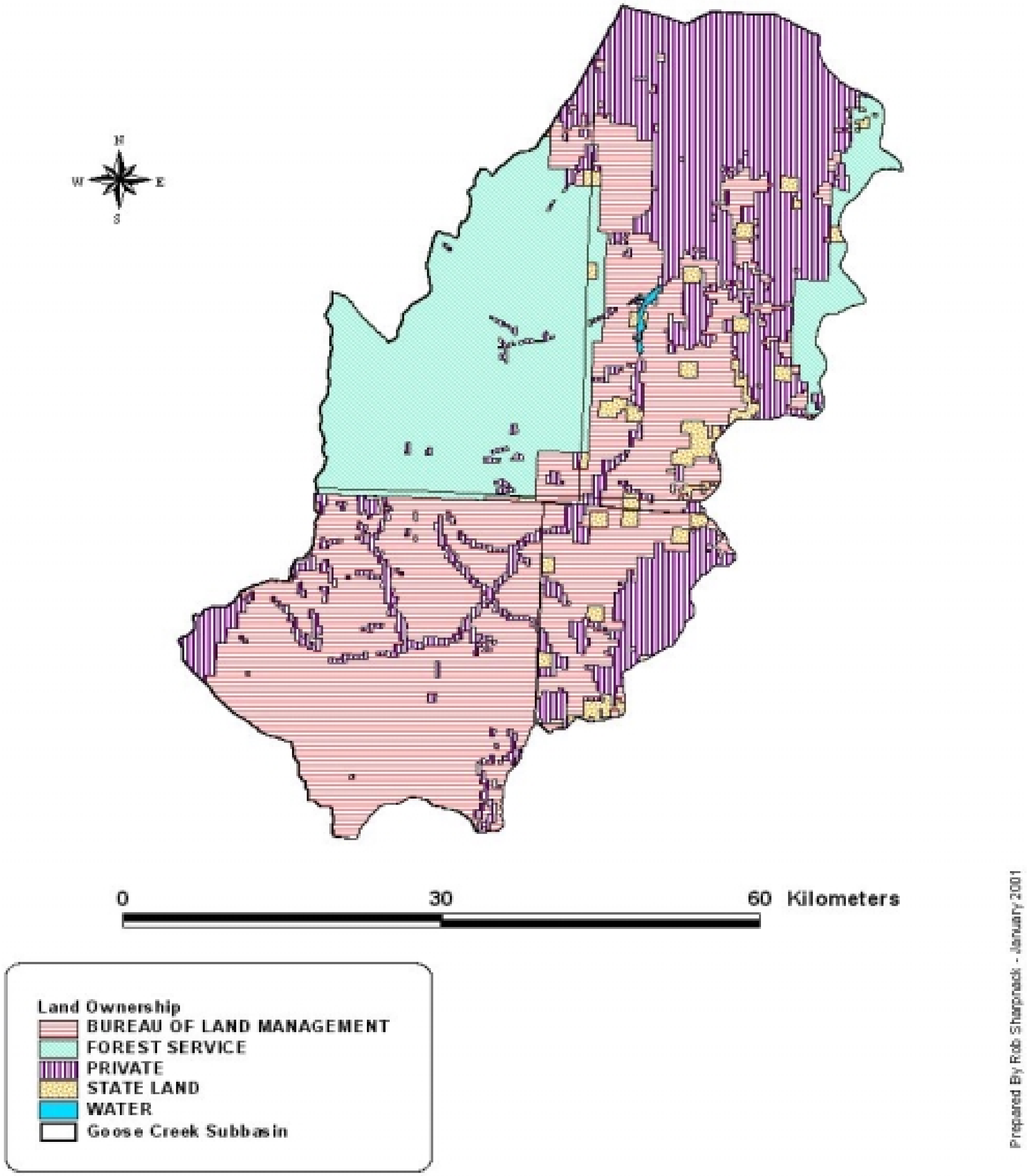
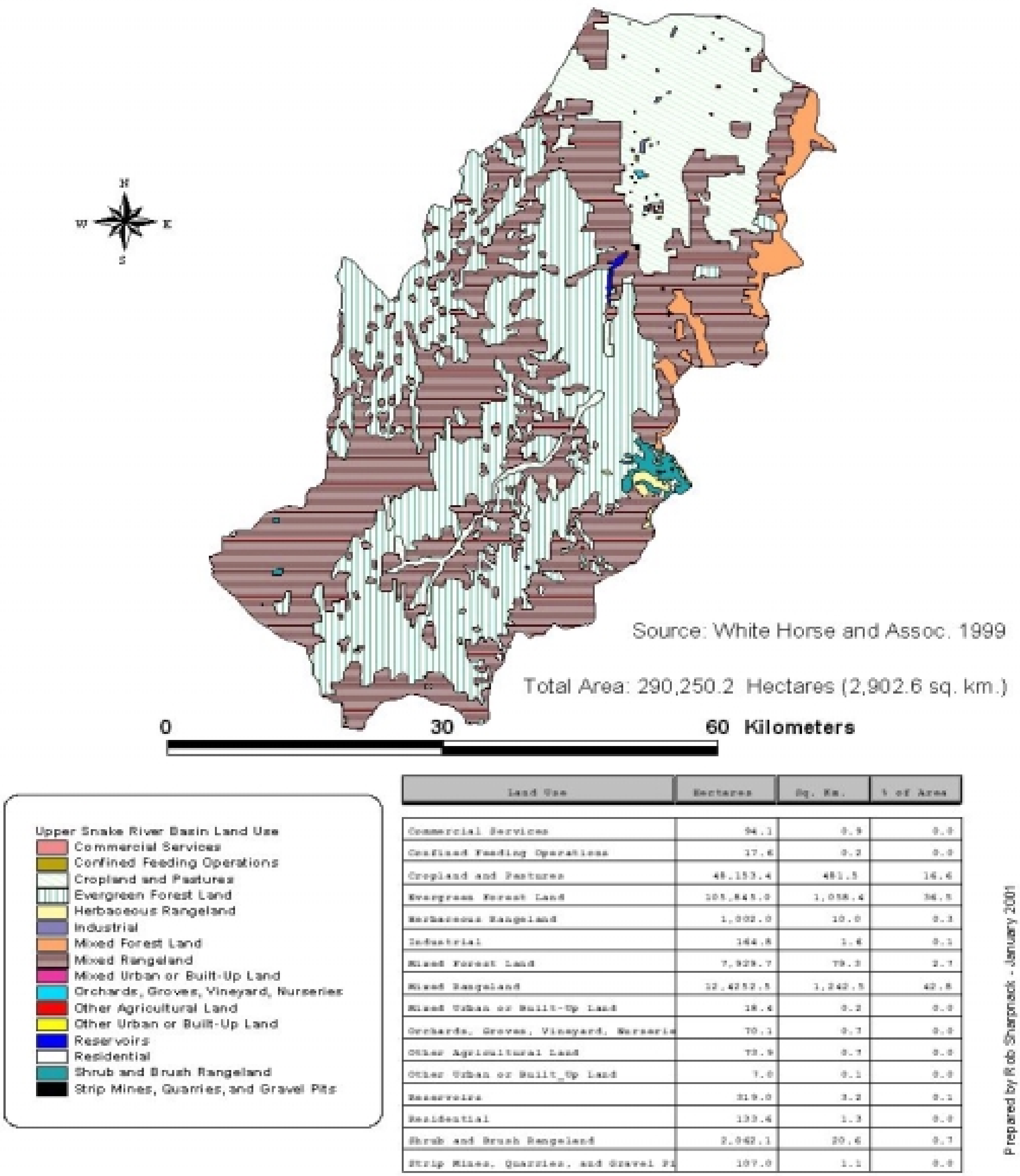


Figure 12. Land ownership of the Goose Creek Subbasin.



Land Use	Hectares	Sq. Km.	% of Area
Commercial Services	94.1	0.9	0.0
Confined Feeding Operations	17.6	0.2	0.0
Cropland and Pastures	48,153.4	481.5	16.6
Evergreen Forest Land	105,845.0	1,058.4	36.5
Herbaceous Rangeland	1,002.0	10.0	0.3
Industrial	164.8	1.6	0.1
Mixed Forest Land	7,929.7	79.3	2.7
Mixed Rangeland	12,4252.5	1,242.5	42.8
Mixed Urban or Built-Up Land	18.4	0.2	0.0
Orchards, Groves, Vineyard, Nurseria	70.1	0.7	0.0
Other Agricultural Land	73.9	0.7	0.0
Other Urban or Built_Up Land	7.0	0.1	0.0
Reservoirs	319.0	3.2	0.1
Residential	133.4	1.3	0.0
Shrub and Brush Rangeland	2,062.1	20.6	0.7
Strip Mines, Quarries, and Gravel Pi	107.0	1.1	0.0

Figure 13. Land use in the Goose Creek Subbasin.

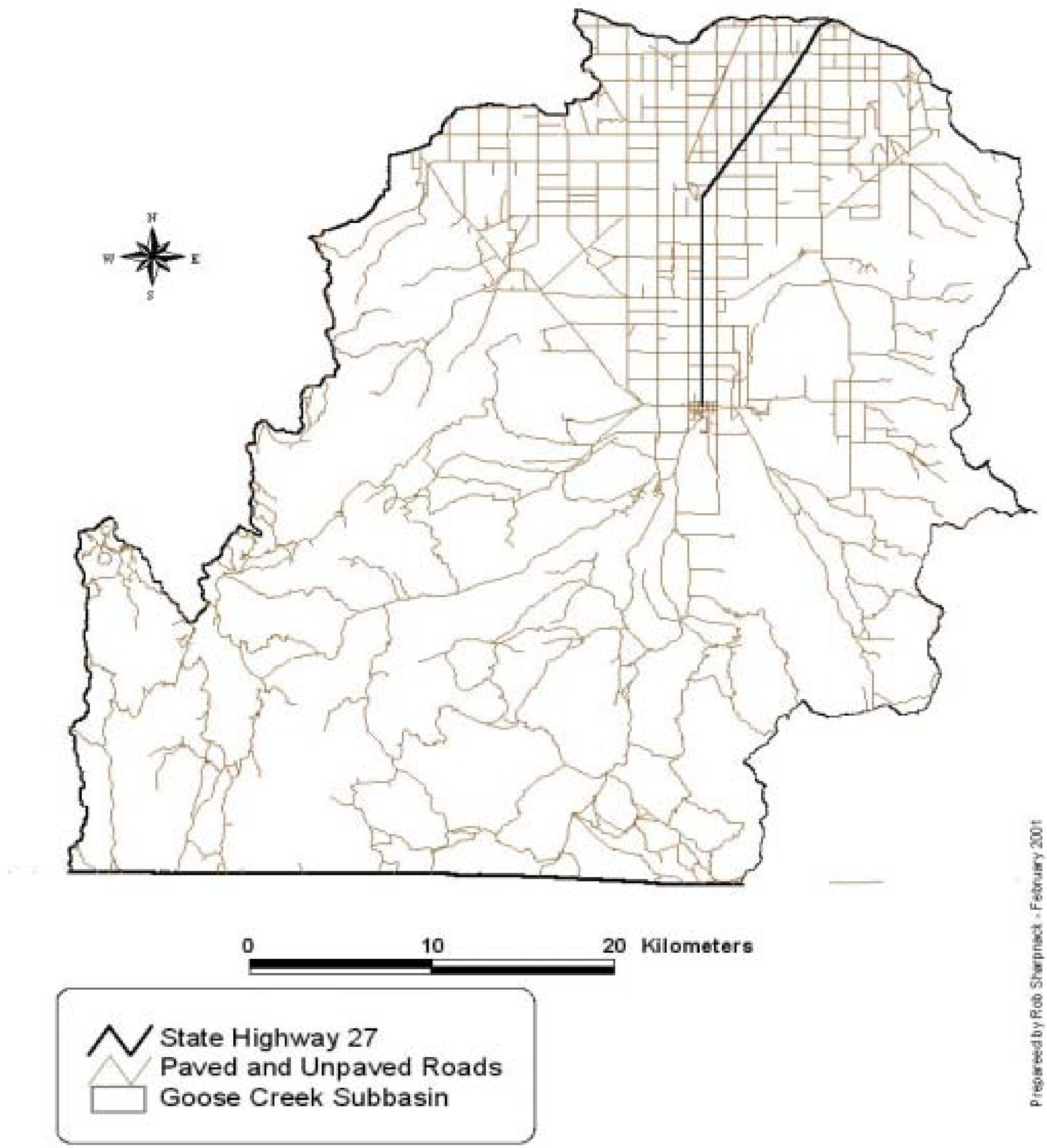


Figure 14. Paved and unpaved roads within the Goose Creek Subbasin (Idaho portion).

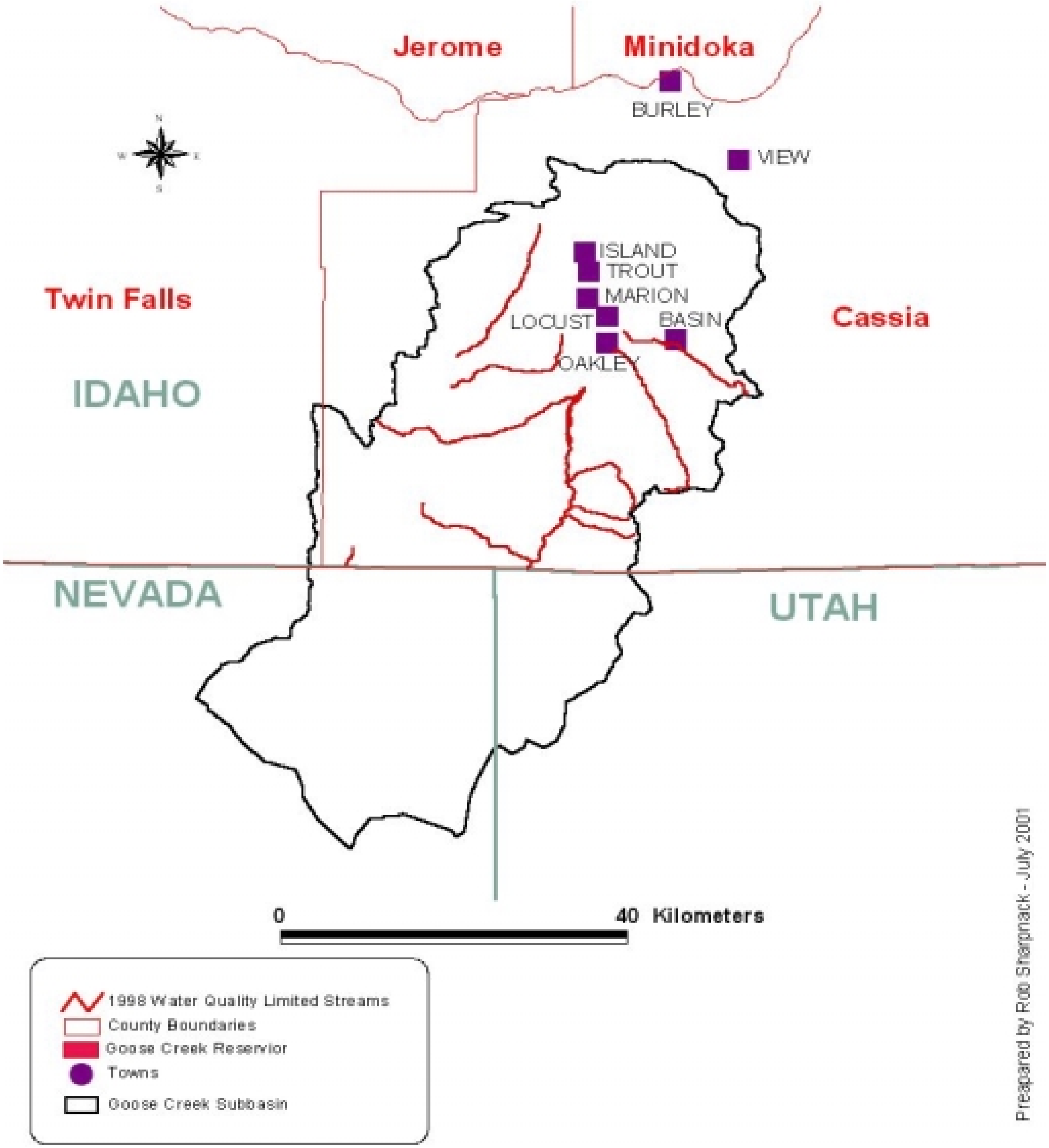


Figure 15. State and county boundaries and the location of several small towns and communities within the Goose Creek Subbasin.

History and Economics

The principal economic activity within the Goose Creek Subbasin is agriculture. In the lower portion of the subbasin, below Goose Creek Reservoir, row crop agriculture dominates. Potatoes, sugar beets, and hay are the primary crops. Two potato processing plants are located in the Burley area. Sugar processing plants are also located in the Paul and Twin Falls areas. Consequently, the farmers find a ready market for their products. In recent years, large industrial dairies and cheese plants have begun to locate in the south central Idaho region. These dairies have added a demand for hay and corn.

In the upper portion of the subbasin, cattle and sheep ranching are the dominant economic activities. However, recreation plays a significant role as well. Hunting and fishing opportunities bring many people into the subbasin throughout the year.

In most areas of the subbasin hydrologic modifications to the tributaries and mainstem streams have been extensive. Goose Creek Reservoir was built in 1911 and has dewatered Goose Creek from the dam to the confluence of the Snake River. In the 1970s a city of Burley judge ruled that the Goose Creek channel through the city of Burley no longer existed. This allowed for development of commercial and residential buildings in the floodplain and stream channel. In 1985, a District Judge for Cassia County declared that the Goose Creek channel below the reservoir no longer existed. Prior even to that ruling the streambed had been plowed in and used for home sites and row crop agriculture. Many streams are diverted from their original streambeds to new locations. For example, Birch Creek is diverted from its original stream course into the Goose Creek Reservoir, and Summit Creek has been diverted from one valley into another since as far back as the 1800s. Other historical modifications include channelization, such as in the lower portions of Mill Creek. Furthermore, most of the water bodies have control structures or pumps fully capable of removing all the water from the stream. However, most of these structures and pumps are the result of water rights that predate the CWA and will be considered as part of the subbasin characteristics in any water quality plan (see IDAPA 58.01.02.050.01).

An integral part of the SBA-TMDL development process is public participation. The public has been invited to participate throughout the process in different forums. These include soliciting input from the interested citizens of the towns of Oakley and Burley, the Upper Snake Basin Advisory Group (BAG), and the planned public release of draft documents for review and comments. A distribution list will be located in Appendix C following the public comment period. Public comments will be located in Appendix D following their receipt. As envisaged in Idaho’s 39-3601 et seq. legislation and Idaho’s TMDL process, watershed advisory groups (WAGs) are to be used to encourage public participation. Public involvement for the Goose Creek Subbasin has taken place concurrently with the development of the SBA and TMDL. The BAG has also provided input into the Goose Creek SBA-TMDL.

The Upper Snake BAG provides guidance and advice to DEQ in the final development of SBAs and TMDLs in the Upper Snake Basin. Part of this assistance consists of review of documents after formal presentation and providing comments and assistance.
Following public announcements, meetings were held in the Goose Creek Subbasin to relay progress of the SBA and TMDL process. The first of these meeting was held in the city of Oakley in June 2001. There is an informal Goose Creek area citizen's group, but it has not undergone any formal recognition by the BAG and has not undertaken any formal organization into a WAG outside of nominating a local citizen to sit on the Lake Walcott WAG. Carl Austin of Oakley, Idaho, accepted this role. The group is an informal group and will use the Lake Walcott WAG as a platform for organization. The group will also be provided comments on the progress of this SBA-TMDL through Carl Austin and the Lake Walcott WAG.

Local soil conservation districts (SCD) began organizing in Idaho in 1940 and are legal subdivisions of state government whose volunteer district supervisors are locally elected. The district supervisors have encouraged participation from their constituents in the Goose Creek SBA-TMDL activities. Two districts are within the area of the SBA. The main goal of the SCDs at the time of organization was to assist each operator in the district with the development of a soil and water conservation plan for his or her operations. The SCDs currently have placed irrigation water management, rangeland management, animal waste management, and protection of wildlife habitat as high priorities in long-range resources conservation programs.

The East Cassia SCD (Burley) was organized in 1956. Some initial conservation measures undertaken by this organization were windbreak plantings, range improvements, and grass seed plantings. Some later measures included terracing eroding farmland and converting to sprinkler irrigation systems. The district receives operating funds from Cassia County and the state of Idaho and supplements these funds by renting equipment and selling trees for windbreaks (Idaho Association of Soil Conservation Districts 1998).

The West Cassia SCD (Burley) organized in 1958. Its present priorities are improveing water management in irrigated land and installing terraces on non-irrigated cropland. Presently it is working to complete a study in the Oakley Fan area to decide how best to augment underground aquifers and is cooperating with local power companies to increase the efficiency of irrigation pumps. Its programs are also funded by Cassia County and the state of Idaho, and are supplemented by conducting snow surveys for the Natural Resources Conservation Service (NRCS), renting equipment, and holding auctions (Idaho Association of Soil Conservation Districts 1998).

Upper Snake Basin Advisory Group

The BAGs are stewards of water quality in specific basins. The Idaho legislature codified this stewardship role Idaho code 39-3601 et seq. The BAG provides direction, advice, and guidance to DEQ and local WAGs within the different basins. Providing review and comments on the Goose Creek SBA were a part of the Upper Snake BAG's water quality stewardship program. The results of the Goose Creek SBA were presented to the Upper Snake BAG on October 3, 2001.

Goose Creek Committee of the Lake Walcott Watershed Advisory Group

The local citizen groups, such as the Cassia County Public lands Committee and the Lake Walcott WAG, have been a vehicle for public participation concerning the Goose Creek TMDL. An informal group in the town of Oakley has met several times during the development of the SBA. During this time the methods and results of various stages of the assessment and TMDL development processes have been presented to the group. A draft document will be made available to the citizens during the public comment phase. In addition, the Lake Walcott WAG has served as an official public forum for the Goose Creek SBA and TMDL. The Lake Walcott WAG meets bi-monthly in the city of Burley. At these meetings implementation of the Milner Pool TMDL are discussed as well as developments of the Goose Creek and Raft River SBAs and TMDLs.

Public Notice

Although no official public comments were solicited by DEQ concerning the SBA phase of the TMDL development, comments were received and incorporated into the draft SBA-TMDL. An official 30-day public notice and comment period for the draft SBA-TMDL will commence on November 12, 2003. The document will be finalized and presented to EPA on December 31, 2003.